Agricultural Economics RESEARCH

CONTENTS FOR APRIL 1953 — *Vol. V, No. 2*

		Page
Discussion of Congressional House Committee Report of the Investigation of the Federal Crop Reporting Service		
Introduction	*Charles F. Sarle*	25
Discussion of Subcommittee's Recommendations: Summary of Remarks	*John J. Heimburger*	26
Estimating the United States Cotton Crop	*J. Roger Wallace*	28
Improving the Crop Reports	*Lauren Soth*	34
Evaluation of Wheat Crop Production Estimates	*John D. Baker, Jr.*	37
Probability Sampling as a Method of Obtaining Objective Facts	*Morris H. Hansen*	38
Book Reviews	*F. F. Elliott, Raymond P. Christensen, O. V. Wells,* and *J. Richard Grant*	40

UNITED STATES DEPARTMENT OF AGRICULTURE • Bureau of Agricultural Economics

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. • Price 20 cents

Contributors

Contributors are on the Staff of the Bureau of Agricultural Economics unless otherwise stated

CHARLES F. SARLE, Market Research Counselor, National Analysts, Inc., Philadelphia, formerly was head of the Division of Special Farm Statistics of Agricultural Estimates, BAE.

JOHN J. HEIMBURGER served as counsel of the special subcommittee of the Committee on Agriculture of the House of Representatives which prepared the report, "Crop Estimating and Reporting Services of the Department of Agriculture."

J. ROGER WALLACE, commodity editor of the *Journal of Commerce*, was employed in the late 1920's by the Garside Cotton Service, which made cotton estimates. Later he served as a cotton economist for the Federal Farm Board. For the last 3 years, he has been making cotton estimates which are published regularly in the *Journal of Commerce*.

LAUREN SOTH is a member of the editorial staff of the *Des Moines Register and Tribune*. Formerly on the staff of Iowa State College, he edited the *Iowa Farm Economist*, a journal of applied economics issued by the college.

JOHN D. BAKER, an economist with Longstreet, Abbott Company of St. Louis, wrote his doctor's thesis at Purdue University on the problem of evaluating the accuracy of the economic outlook forecasts of the Bureau of Agricultural Economics. This study, which included an evaluation of the official forecasts and estimates of winter and spring wheat production, was summarized in the October 1952 issue of *Agricultural Economics Research*.

MORRIS H. HANSEN is Assistant Director for Statistical Standards in the Bureau of the Census. He is president and fellow of the Institute of Mathematical Statistics and vice-president and fellow of the American Statistical Association.

F. F. ELLIOTT, Associate Chief of the Bureau of Agricultural Economics, is in charge of coordination of economic research and statistics.

R. P. CHRISTENSEN does research in production economics and directs foreign trainee programs in economic investigations for BAE. He returned to the Bureau last November following a 1-year assignment at the Agricultural Economics Research Institute as technical consultant in agricultural economics under the auspices of the Ministry of Agriculture and Fisheries of England and Wales and the Mutual Security Agency of the United States.

O. V. WELLS, Chief of the Bureau, has observed the interaction of Government and agriculture, sometimes as special adviser or counselor and always as research scholar, since 1929 when he entered Government service as junior economist in the United States Department of Agriculture.

J. RICHARD GRANT is statistical clearance officer in the Office of the Chief of BAE. He returned recently from Israel, which he served as adviser in agricultural statistics for 6 months on assignment from FAO.

EDITORS: CHARLES E. ROGERS
HERMAN M. SOUTHWORTH

AGRICULTURAL ECONOMICS RESEARCH

A Journal of Economic and Statistical Research in the
Bureau of Agricultural Economics and Cooperating Agencies

Volume V APRIL 1953 Number 2

Discussion of Congressional House Committee Report of the Investigation of the Federal Crop Reporting Service

We are devoting this issue of Agricultural Economics Research *to papers delivered at one of the sessions of the recent Chicago meeting of the American Statistical Association, which was jointly sponsored by the American Farm Economic Association. This session, organized partly as a result of suggestions coming from the Bureau, was devoted to a discussion of the recommendations contained in the report on crop estimating and reporting methods made by a Special Subcommittee of the House Committee on Agriculture, which was released last June.*

In publishing this material, we are expressing neither agreement nor disagreement with the conclusions reached or points raised by any of those who appeared on the program. As a matter of fact, there are several places where I am sure that our statisticians would disagree—for example, the question of how to devise and put better sampling methods into use is certainly important, but we would not, I think, be willing to agree that this is the only or one all-important problem facing the Crop Reporting Board. At the same time we would also argue that some materials which are sometimes considered as forecasts by those outside the Bureau—as for example the March Intentions to Plant materials—are not forecasts in the sense in which that word is ordinarily used. But these matters are beside the point. Here is a series of papers prepared by an able group of speakers, all of whom are outside the Bureau. They do represent the kind of viewpoints which some well-informed persons outside the Bureau hold, and they are a serious effort to analyze the recommendations of the recent House Subcommittee report on Agricultural Estimates and should, it seems to me, be of interest to practically all professional personnel in the Bureau.

O. V. Wells

Introduction

By Charles F. Sarle

AGRICULTURAL STATISTICS issued by the United States Department of Agriculture serve as a highly important and fundamental function in the operation of our national economy. The greater the accuracy of these official forecasts and estimates, the smaller the element of risk that must be borne by the buyers and processors of agricultural products, and the smaller the price margin between farmers and consumers. Accurate estimates of agricultural production are essential to the smooth functioning of our national economy,

whereas statistics of less than attainable accuracy create economic friction. They act as sand thrown into the complicated gears of our system of distribution. They may even adversely affect employment of labor in the processing industries, as was the case with the estimates of the 1951 cotton crop.

Deviations (usually spoken of as errors) between preliminary estimates or forecasts of crop production and the final estimates may be divided into three major groups:

(1) Deviations due to the methods of sampling and estimating used by the Department.

(2) Deviations caused by actual changes in crop production, or acreage prospects, between the date to which the forecast relates and the time when the crop is harvested.

(3) Deviations resulting from policy decisions, such as the nonuse of weather and other information concerning current crop prospects between the time when the crop correspondents mail their questionnaires and the day when the crop report is issued. In the case of cotton reports, this policy decision is specified by Congressional action.

The purpose of our discussions is to consider, primarily, the first of these causes of deviations and to make suggestions as to methods of sampling and estimating that could be expected to result in an increase of the accuracy of national forecasts and estimates of the major crops and kinds of livestock. The recommendations of the House Committee Report [1] were not limited to the cotton crop reports.

In view of my long, but somewhat intermittent, association with the Crop and Livestock Estimating Service since the early 1920's—first, as the Federal-State Statistician in Iowa and later as a member of the Crop Reporting Board—and because of my active participation in methodological research involving probability sampling and weather-crop relationship studies extending over several years, I was especially interested in the House Committee Report. I feel that this report, which Mr. Heimburger summarizes, is an excellent and nontechnical presentation of crop-reporting problems. Most of the Committee's recommendations appear to be basically sound and practical. Some need amplification and a few would probably contribute little or nothing to increasing accuracy; they might even be harmful. These are points that are touched upon in our discussion.

[1] UNITED STATES CONGRESS. HOUSE, COMMITTEE ON AGRICULTURE. CROP ESTIMATING AND REPORTING SERVICES OF THE DEPARTMENT OF AGRICULTURE. REPORT AND RECOMMENDATIONS OF A SPECIAL SUBCOMMITTEE. U. S. 82d Cong., 2d Sess. Committee Print. 75 pp. Washington, U. S. Govt. Print. Off. 1952.

Discussion of Subcommittee's Recommendations

Summary of Remarks by John J. Heimburger

THE HOUSE AGRICULTURE COMMITTEE approached the subject of the crop reporting service from a nontechnical viewpoint, in the hope that its findings would have the double effect of arousing general public interest in the improvement of the crop reporting procedures, and of focusing on those procedures the attention of technical experts who are competent to make affirmative suggestions for improvement. Mr. Heimburger said that the action of the American Statistical Association in taking up the report was therefore directly in line with the objective the committee had in mind. He expressed his own hope that the association might appoint a permanent committee on the subject or take some similar continuing interest in the improvement of agricultural statistics.

The committee's study dealt in detail only with the crop estimating and reporting procedures in regard to cotton, and specifically with estimates and reports of the 1951 crop. But it was the understanding of the committee that the procedures relating to cotton are enough like those for other crops so that its comments and recommendations would apply generally to the crop reporting and estimating program.

One of the most disturbing things to the committee in the course of its study was the fact that, in spite of gradual improvement of cotton crop reports over a long period, an error as large as that which occurred in 1951 is still possible, and apparently can be neither anticipated nor prevented under the present estimating methods. The subcommittee specifically commended the officials of the Bureau of Agricultural Economics for their cooperation in the study, but it described as "most discouraging" the attitude that errors such as that of 1951 are inherent in any human undertaking and, although regrettable, are unavoidable and likely to occur in crop reports at any time in the future.

The committee considered at length the sources of information on which crop estimates are based and concluded that they could be both improved and extended. It recommended improvement of the voluntary crop-reporter lists and the utilization of other sources of basic information. It proposed that the field of objective measurements be carefully re-examined and their use reintroduced into the estimating procedure.

The committee was critical of the schedules on which crop reporters are asked to transmit their information. It pointed out that several of the questions called for an estimate or an exercise of judgment on the part of the reporter rather than the mere reporting of facts within his knowledge, and that some of the questions and definitions on the schedules appear to be unnecessarily complex and difficult to understand.

Special Research Unit Within BAE Recommended

The most important single recommendation made by the subcommittee, in its opinion, was for the establishment of a special unit within the Bureau of Agricultural Economics specifically to carry on research, analysis, and experimentation designed to discover the shortcomings of our present estimating procedure, to develop and try out new procedures, and to recommend improvements.

At this point, Mr. Heimburger suggested there had been some misinterpretation of the statement of the committee referring to "modern methods of statistical sampling" in its recommendation relating to regression charts. It was not the intention of the committee, he said, to discourage the use of improved sampling methods in the collection of data. On the contrary, it was assumed that one of the major fields to which the proposed research unit would turn its attention would be the determining of the extent that improved sampling methods could be used in agricultural estimating.

The committee devoted a great deal of study to the apparent failure of the 1951 cotton crop report to reflect the effect of adverse weather on the crop until several weeks after the damage had been done. From study of available records of weather the committee came to the conclusion that the dry hot weather, admittedly an influential factor in reducing the size of the 1951 crop, occurred chiefly during July and August and ended early in September. After the middle of September, the weather was generally more favorable than normal for the development and harvesting of the crop.

In spite of the fact that most of the bad weather occurred before issuance of the September cotton report, the production estimate made at that time was even higher than the estimate made on August 1. Although the period of unfavorable weather ended 3 weeks before the issuance of the October report, it was not until a full month later—when the November report was issued—that the effect of unfavorable weather conditions on the crop became apparent in the production estimates.

The committee was disturbed by this apparent lag in reflecting in crop estimates the effects of unfavorable weather. It recommended that the whole operation of crop estimating, from the selection of sources of information to the final making of national production estimates, be reviewed in an effort to discover the reason for this time lag, and to find methods by which weather influences can be reflected more quickly and accurately.

The committee was also disturbed by the fact that nowhere in the crop estimating and reporting procedure is any attempt made to adjust the estimates statistically by applying to the reported data a factor that will make allowances for the probable future effect of past or present weather conditions.

Estimating the United States Cotton Crop

By J. Roger Wallace

THE SPECIAL SUBCOMMITTEE of the House Committee on Agriculture is to be complimented upon its excellent report "Crop Estimating and Reporting Services of the Department of Agriculture" that has been so well summarized by John C. Heimburger, Counsel for the House Agricultural Committee. This report, as stated in the foreword, was based on nontechnical evaluation of the methods and procedures of the Crop Reporting Board. In this paper, I will attempt to make a somewhat technical evaluation of the recommendations made in the report, and I would like to suggest a few in addition. From my experience and study, I would say that several of these recommendations are really basic, others are essential, and a few have little or no value.

As I see it, there is room for considerable improvement in making estimates of the cotton crop with the tools that the Board already has at its disposal. If, in addition, the more basic recommendations of the committee, along with several other suggestions that will be made, could be effectively implemented in terms both of funds and of administration, the accuracy of the United States estimates for cotton and other major crops could—there is reason to believe—be materially increased within a few years. The additional annual cost should be no more than a tiny fraction of the estimated $125-million loss that the errors in the 1951 crop estimates are claimed to have cost cotton farmers.

No other major crop, with the possible exception of tobacco, has figures for checking purposes that are as accurate as the final ginnings of cotton. More time and effort is put into making estimates of cotton than in the estimates of any other single crop. The methods of sampling and estimating used in making the August and September estimates are essentially the same as those used for other major crops. Furthermore, the figures of ginnings reported currently during the fall have contributed materially to increasing the accuracy of the October-December estimates of cotton production.

The major consideration at present is the improvement of the August and September cotton estimates. With this accomplished, the later estimates would tend to improve almost automatically, since they appear to be influenced by the earlier estimates. At this point, we should consider a highly significant fact concerning the September cotton crop estimates.

The Special Subcommittee report notes (page 8) that the over-all trend of average deviations, disregarding signs, between the August United States estimate and the final ginnings figures from 1915 to 1949, is improving. Comparing the average of these deviations for the first 10-year period (1915-24) and the 10-year period ending in 1950 (table II), it will be observed that they declined nearly 40 percent for the August estimates and about 50 percent for the October and December estimates, but less than 30 percent for the September estimates.

This relatively poor showing of the September cotton crop estimates is surprising when we consider that the crop has been largely made by September 1, and that a small but important part of the crop usually has been ginned by that date. It is interesting that both the 1951 and 1952 September estimates deviated more than the August estimates from the final estimate, considering the December estimate as final for 1952. This leads to the question of the extent of improvement in the production estimates of other important crops. Perhaps Dr. Baker will give us some indication of this.

While on this subject of deviations, it is important to note that the deviations by States, in the August and September cotton estimates, are much greater—in fact, shockingly greater—than the deviations in the August and September United States cotton estimates. These are discussed in detail later.

New Research Unit a Basic Need

Unquestionably, the most basic recommendation of the Committee was that for the establishment within the Bureau of Agricultural Economics of "a unit devoted entirely to research, analysis, and experimentation directed at discovering the shortcomings in the Bureau's present methods and developing improvements

therein." Such a unit is essential in an organization that is primarily for service, such as the Agricultural Estimates Branch of the Bureau of Agricultural Economics. Research should not be confined, of course, to cotton-crop estimating alone. The Bureau has recognized the importance of this recommendation and is requesting additional funds for carrying it out.

Such a research unit could implement several of the recommendations of the Committee, especially those referring to an objective evaluation of the influence of weather on the growth and yield per acre of cotton and of other major crops, and the use of objective measurements of crop development and production such as those obtained from cottonboll counts and field measurements of corn, other grains, soybeans, and so on.

The value of the regression-chart system would be materially enhanced by using weather factors as additional independent variables. It is particularly important to ascertain, if possible, the degree of truth in the contention that weather developments prior to the report reference date are not fully reflected in the reporters' estimates of condition.

A research unit could demonstrate the practical application of scientific methods of sampling in obtaining basic information from farmers on the acreages and production of cotton and other crops, livestock numbers, and stocks of grain.

Vast research already has been conducted in these directions both in the United States and in several foreign countries. The results have been summarized in *Methods of Crop Estimating,* an unpublished work by Fred H. Sanderson, now in the State Department. Considerable research of this type was conducted under the direction of Charles F. Sarle and others who were with the Bureau of Agricultural Economics.

Earlier Research Used by Government Agencies

Following are a few examples of the results of this earlier research that are now being used by other agencies of the United States Government and of several foreign governments.

Area probability sampling was developed at Iowa State College by the Bureau of Agricultural Economics and by the Bureau of the Census under the direction of Arnold J. King. This scientific method of sampling farms and households is now in general use by the Bureau of the Census, several State colleges and universities, and a few marketing research agencies. Although used by several foreign countries in crop estimating, it is not so used by the Bureau of Agricultural Economics, one of the agencies that developed the method.

Long-range weather forecasting research was conducted at the Massachusetts Institute of Technology under the direction of Professor Carl Rossby. The purpose was to develop valid methods of long-range weather forecasting to improve the accuracy of crop-production estimates. This project was transferred to the Weather Bureau in 1941 when that Bureau began to issue 5-day weather forecasts.

Research on the effect of weather on the yield per acre of cotton, corn, and winter and spring wheat, was conducted in cooperation with a number of State Agricultural Experiment Stations in 1938-40. This research involved specially designed field-crop experiments and crop and weather measurements.

Statistical studies of the relationship of weather to crop yields were conducted, some of which showed promise. Now that 5-day weather forecasts are issued twice a week by the Weather Bureau, it should be possible to use them to improve the findings based on condition and other factors between the report reference date and the issuance date.

The House Committee also made the important recommendation that the Bureau of Agricultural Economics collaborate with the Bureau of the Census in the taking of an annual census of agriculture. An annual sample census taken in the fall, using area probability sampling, should be more valuable to the economy of the United States than the quinquennial agricultural census, and, over a 10-year period, need not cost much more. This would furnish a valid basis for the harvested acreages of cotton and the harvested acreages and production of other major crops.

The Committee thought that a crop-estimating and reporting system based entirely on modern methods of statistical sampling would be much more costly than the methods now

used, and doubted that the improvement in accuracy would justify the cost. There is no doubt about this; nevertheless consideration should be given to using scientific sampling methods where they are most needed and when cost would not be greatly increased, in order to place a sound foundation under the crop-reporting system.

From the standpoint of the cotton farmer and the entire cotton trade, the primary objective should be to provide more accurate crop estimates at the national level. They are what determine prices. At present, the primary objective seems to be to provide serviceably reliable estimates at the State level in the hope that the national estimate will be reliable. Analysis of reliability of State estimates, to be discussed later, indicates that good luck rather than good management has prevented most of the early-season cotton-crop estimates from being as far out of line as the 1951 estimates.

Size and Cost of Needed Sample

With the primary objective firmly established to provide more accurate crop estimates at the national level, no large area probability sampling of farms would be required. From data already collected, the size of the sample needed and the probable cost can be fairly well determined.

1. An annual census of agriculture, taken in the fall, to replace the quinquennial censuses, would not be excessive in cost. It would provide a high level of accuracy at the national level and probably would improve the State estimates. With the national crop estimates on a sound scientific basis, smaller mailed samples than those now employed could be used to pro-rate the national estimate among the States, bringing considerable monetary saving. Cotton does not fit directly into this picture since we have a reliable measure of final ginnings, but the problem of estimating the cotton crop cannot be considered without taking other agricultural enterprises into account.

2. Obtaining more accurate early-season estimates of acreages remaining for harvest is the next problem. This problem played a large part in wrecking the 1951 cotton-crop estimates. A national area probability farm survey taken about July 1 would help. Improvements in the present system of mailed sampling may be possible, to improve the July acreage estimates. Then, the acreage for harvest could be estimated on September 1 to provide a sound basis for truing up the estimates of the earlier crops.

It has been estimated that a national area probability sample of somewhere around 10,000 farms would be sufficient to provide national estimates of acreage and that the cost would be less than $150,000. If, owing to peak-load activities, the Bureau of Agricultural Economics is unable to conduct a July sample farm survey, it could be contracted out to one of the private agencies that are competent to handle this problem.

In the years that lie ahead, it appears virtually certain that contraction of export markets for cotton and others of our farm products will necessitate cut-backs in acreage in several of the major crops. Experience shows that the mailed-survey method of estimating acreage falls down whenever the Production and Marketing Administration is endeavoring to effectuate national acreage "goals." Under present-day conditions, the only alternative to a national area probability sample survey of acreage is actual measurement of a small sample. This would be very expensive and probably would yield no better results.

3. The basic problem of increasing the accuracy of estimates of yield per acre can be met by methods developed through research, making more effective use of reported crop condition, and utilizing weather data and objective measurements obtained from area probability sampling.

There is little doubt that the accuracy of the cotton-crop estimates can be improved considerably as a result of research and the application of more scientific methods, coupled to some extent with improvement of the present system.

More detailed observations on the accuracy of the cotton crop reports in recent years will now be considered, together with suggestions for improvement within the present system.

There is a tendency, on the part of both the Board and the public generally, to evaluate cotton crop estimates solely from the standpoint of their accuracy with respect to actual productions on a total basis. The August crop estimate, of say 15,000,000 bales, is compared with the actual outturn of 15,200,000 bales, and is adjudged to have been a very good estimate.

This we may call an over-all evaluation. There is nothing like it to induce complacency on the part of those who make estimates and those who use them.

Evaluating Crop Estimates by States

The real test of crop estimates under the present system is by States. Admittedly, there is a certain amount of give and take in the making of any estimate. All of us have a tendency to lean a little backward here if we think we may have leaned a little too far forward there. Try as we may, the human equation cannot be eliminated entirely.

In evaluating the accuracy of cotton-crop estimates by States, it can be contended that unfavorable weather developments in some States, after the making of the estimate, were largely offset by favorable developments in other States. Undoubtedly, that happens sometimes but it cannot happen most of the time.

Evaluation of the cotton-crop estimates by States for August and September for 1950, 1951, and 1952, reveals some rather shocking deviations from the final outturn. For 1952, the December estimate was used for the final outturn, which will not be available until May 1953.

The August 1950 estimate of 10,308,000 bales deviated only 3.0 percent from the actual outturn but the average deviation for the State estimates was 11.4 percent. In calculating the deviations, signs have been omitted. Virginia, Florida, and "Other States" were omitted from the calculation of the average deviations since they are relatively unimportant from the standpoint of cotton production. Also, the Virginia deviation was 150 percent and would have exerted undue influence on the averages. The deviation for the total September 1950 estimate was 1.3 percent; the average of the State deviations was 10.5 percent. The August range was from 0.9 percent to 27.1 percent; the September range was 0.9 to 18.1 percent.

The same test applied to the August 1951 estimate showed a total deviation of 15.9 percent and an average deviation by States of 12.8 percent. The range was 0.8 to 47.2 percent. For September 1951, the total deviation was 14.2 percent, the average of State deviations 13.0 percent, and the range 0.4 to 35.3 percent. Evaluated from a State standpoint, the August and September 1951 estimates were not much worse than the 1950 estimates. The trouble was that practically all of the deviations carried plus signs.

The August 1952 estimate of 14,735,000 bales, showing a deviation of only 2.0 percent from the December estimate which we are considering here as the final outturn, actually was the worst of the lot. The average of the State deviation was 15.2 percent and the range from 3.0 to 61.5 percent. The September estimate, with a total deviation of 7.6 percent, showed an average deviation by States of 10.3 percent with a range from 4.1 to 17.6 percent.

It is rather surprising to discover that the August 1952 estimate, evaluated from a State standpoint, was worse than the August 1951 estimate. There is no room for complacency in this evaluation. Criticism may be in order for using a straight average for the State deviations without regard to the relative importance of each State from the standpoint of cotton production. Nevertheless, this evaluation points up the essential weaknesses of present cotton-crop reporting methods.

So far as known, no attempts have been made to ascertain to what extent the deviations in the respective August and September State estimates were due to unforeseeable weather factors. As weather conditions during August are influential in determining yields, it could be argued that most of the deviations in the August estimates were due to unforeseeable weather factors. By September 1, however, most of the crop is made and it takes unusual weather after that date to change the crop prospect very much. As the deviations by States tend to be in the same direction for August and September, that weakens the weather argument for the August deviations.

As long as these wide deviations in the State estimates are tolerated, there will be the possibility, indeed the probability, that occasionally the majority of the deviations will be in the same direction, with a resultant substantial overestimate or underestimate of the United States crop. To assume that the errors in one direction will about offset the errors in the opposite direction is tantamount to trusting in blind luck. Yet that seems to be the basis on which the Crop Reporting Board is working.

Since the October estimates are based partly and the November and December estimates almost entirely on ginnings to date and the estimated percentage of the crop ginned as determined from reports of ginners, we have been inclined to think of the necessity of effecting a relatively smooth transition from the August and September estimates—based largely on reported condition and reported boll-weevil infestation—to the later estimates. However, analysis of ginners' estimates of the percentage of the crop ginned indicates that ginners, in making their October and November indications of percentage ginned, are influenced to some extent by the official estimates of the

United States Department of Agriculture that have gone before. (If the Board has underestimated the crop in their States, ginners tend to overestimate the percentage ginned, and vice versa.) Improvement in the early-season crop estimates should result in improving the later-season estimates, by reducing the errors in ginners' estimates of percentage ginned.

In making the August, September, and, to a lesser extent, the October crop estimates, the Board relies upon mailed questionnaires. These are tabulated in the State offices, and the State averages for condition, boll-weevil infestation, bolls safe, date of first open boll, and so on, are forwarded to the Bureau of Agricultural Economics to be used in estimating cotton production by States for all the cotton-growing States. The State statisticians also make their own estimates of State production, which are forwarded to the Bureau of Agricultural Economics where they are given consideration. In a few States, the statisticians go so far as to estimate the production by crop-reporting districts.

Recommendations for Improvement of Estimates

The House Committee made a number of recommendations which it believed would help to improve the cotton crop estimates. The Committee seemed more concerned with the definition of normal condition and the expression of condition in mathematical terms than are the crop reporters, who do not seem to have difficulty in regard to the concept of condition. It must be remembered that even slight changes in time-honored questions would tend to weaken the significance of the replies until experience had been accumulated over a period of years. There appears to be room for improvement in the lists of crop reporters, although it is a moot question whether cotton farmers are the best cotton-crop reporters available.

It is unfortunate that the House Committee did not call upon the American Statistical Association for more expert assistance in evaluating the methods employed by the Crop Reporting Board in estimating the cotton crop. While on this subject, it might be noted that the Board is one of the few government organizations issuing statistical data to the public that has no committee of the American Statistical Association to review its methods and to make suggestions for improvement.

The methods used by the Board to estimate the cotton crops by States as of August 1 and September 1 are, I feel, open to considerable criticism. Some years ago, the Board abandoned the method in use for several years of estimating the yield per acre—through condition, weevil infestation, and other factors—and multiplying it by the indicated area left for harvest, to determine the probable production.

So-called production indices now are computed and plotted against historical production as determined by the census returns on ginnings. One of the reasons given is that it was believed that yield per acre is related to a certain extent to the size of the acreage planted. "Par yields" are computed by dividing historical yields by the November condition. Par yields for the last 10 years are assigned given weights to arrive at a weighted current par yield. The current par yield multiplied by the current condition, multiplied by the indicated area for harvest, divided by 480 (which is the net bale weight) gives the production index. A second independent variable used in this analysis is an index of weevil infestation, computed by multiplying reported weevil infestation by the indicated area left for harvest.

The Board feels that this method has given good results, for some States at least, but, in view of the record, I am not too sure of this.

The November condition figures which are influential in determining par yields, have never been published. The August, September, and October condition figures, however, are published. Personally I do not know what value there is to a November 1 condition figure. By November 1, most of the crop has been harvested and ginned in many States. The quantity left to be harvested varies from year to year, depending upon the earliness or lateness of the crop. This is the cotton most correspondents refer to when they report on November 1 condition. If the crop is entirely harvested by that time, as is often true in the lower part of the Cotton Belt, most correspondents do not report condition. Or they put down a figure just to be agreeable.

Even the October 1 condition does not mean much, if anything, in the earlier areas, as many of our correspondents have taken the pains to tell us.

So, the Board starts off with a par yield derived from an all but meaningless November condition and historical yield. The par yield then is multiplied by the current condition. Here the Board is assuming that there is a straight-line relationship between current condition and current yield. But that is not necessarily true. Many reporters are reluctant to report condition over 100; often they are equally reluctant to report very low condition. Hence, there is a tendency for the relationship between current condition and current yield to be curvilinear, at least for the extremes of condition. The relationship between acreage and yield is nebulous. There may be some relationship between acreage changes and yield, since farmers often are said to take out their poorer lands when they decrease acreage.

Confusion Over Acreage and Yield Indicated

There is evidence, however, that the Board is confused over this matter of acreage and yield. In the old Cotton Belt, acreages now are smaller than they were 20 years ago. In some States, there has been a secular trend in yields for a number of years, largely associated with better methods of farming, and the trend has continued upward even in years when acreage has been increased. The two factors of acreage decrease and yield increase do not appear to be directly related.

Undoubtedly, a seemingly close correlation can be derived between production and the so-called production indices, after adjustment for weevil infestation, in some of the eastern States. For Georgia, for example, almost any kind of a study you want to throw together on factors affecting yields gives good results. But similar studies for other States, particularly the Western States, are worthless.

The evidence, it would seem, is against continuing the use of the production-indices method and for reverting to direct estimating of yield per acre. The deviations in yield that are not explainable by condition, weevil infestation, and other known factors, need to be studied. Some of them undoubtedly are due to weather after August 1 or September 1, as the case may be. The use of even a short-term weather forecast as a supplement to the findings from reports of correspondents should tend to cut down the errors in the August and September cotton-crop forecasts.

Even with a good acreage figure, however, the Board will continue to have trouble in making early-season crop forecasts unless it changes its approach to the problem. For instance, the condition figure—as reported by crop correspondents—bears much less relationship to the yield per acre in some States than it does in others. As a general rule, the significance of the condition figure declines the farther west you go. It is not at all clear why this should be true. But there are some indications that the condition is both a qualitative and a quantitative measure, with the degree varying between the several States. The very fact that we have to modify the findings based on condition with a measure of weevil infestation or probable weevil damage indicates that the reported condition refers, to a considerable extent at least, to the appearance of the plant, with only limited reference to the yield potentialities.

In recognition of this problem, *The Journal of Commerce* several years ago introduced in its crop schedules a quantitative question on probable production, using the ratio approach. Applied to historical production on a crop-district basis, the ratio furnishes on a State-wide basis a measure of what crop reporters expect production to be. Although they may not have a good idea of what their county is likely to produce, most merchants, warehousemen, and ginners do have a good idea of what the area they service is likely to produce, especially on a ratio to historical production basis. We now have several years of such records. The data show promise of becoming increasingly valuable, particularly in the western cotton-growing States. In each of the last 3 years, for example, the September estimates for Texas and Oklahoma, as thus computed, have been considerably closer to the actual crops than have the September estimates of the Crop Reporting Board.

The great advantage of a direct quantitative approach to the problem of estimating cotton production is that it cuts directly across acreage and yield per acre, eliminating the ever-present

possibility that errors in the same direction in both estimates of acreage and yield will be multiplied into a wide over- or under-estimate of the crop. As yet, this method does not give equally good results in all States, but we will know more about it when we have data for a few more years.

As the Cotton Belt is not a homogeneous area, there is no reason why we should not use different approaches to the problem in different States. In the western part of the Belt, where the normal moisture is less than the optimum, an increase in weevil infestation—resulting from more than normal precipitation—can mean something quite different, from the standpoint of yield or production, than would a similar increase in weevil infestation in the eastern part of the Belt, where the normal precipitation is more than optimum. To no inconsiderable degree, we are dealing with separate universes that must be treated separately while endeavoring to find the best method of estimating the crop for each State.

It is gratifying that the Crop Reporting Board this season conducted a split test in two States, one in the East and the other in the West, using a quantitative question at the individual farm or plantation level which could be applied on a ratio basis to a State-wide estimate of the crop. There is reason to believe that the studies originated at *The Journal of Commerce* several years ago prompted this test. It is to be hoped that they will be continued, and conducted on a broader scale than formerly.

There is some question, of course, as to whether a direct quantitative question necessitating responses on a baleage basis with reference to actual individual production last year and estimated individual production in the current year will yield as good results as those where the reference is on a ratio basis. It has been our experience that reporters sometimes furnish two answers to our quantitative ratio question, one giving the estimated ratio for the reporter's own farm and the other for his vicinity or county. Invariably, the individual farm ratio is higher than the vicinity or county ratio. That could mean (1) that crop reporters are better than average farmers or (2) that farms of the crop reporters are not representative of their vicinities even after allowing for this differential.

Within the framework of the present mailed-survey system of cotton-crop estimating, considerable improvement obviously is possible through the application of continuing research. If this could be coupled with the use of more modern methods of sampling and estimating, the possibility of major errors in cotton-crop estimates would be substantially reduced.

Improving the Crop Reports

By Lauren Soth

THE JOB assigned to me is to tell how the crop reports could be improved from the viewpoint of the consumer or user of agricultural statistics. I can certainly qualify as a consumer, or at least as a retailer of crop reports. Our newspapers gobble up all the information the United States Department of Agriculture issues on crop conditions, storage stocks, and so on. We value it highly as news. The figures released not only have an important bearing on markets and consequently are the raw material going into decisions of farmers and other businessmen, they also are the basis for various "automatic" formulas in farm legislation—determining the level of price support, whether crop acreage controls go into effect, and so on.

Now, just as a general comment, before going any farther, I should say that our fact-gathering in agriculture in the last several years has not kept up with our requirements. We have gone farther in the use of the figures than the figures themselves justify. Take the

matter of farm price supports based on parity. Anyone who knows much about local markets and the reporting of those markets realizes that some of the price statistics are shaky ground for all that is built on top of them. We have laws spelling out in great detail just what price supports should be, down to the last percentage of parity. Yet the figures that determine parity are pretty flimsy.

I believe this is generally true of the crop reports and other agricultural estimates. I don't blame the Crop and Livestock Reporting Service, which is made up of as devoted, hard-working, and conscientious people as you'll find anywhere. I believe the Bureau of Agricultural Economics simply has not had enough money to improve its services to the degree that our increased dependence upon those services justifies.

Corn-Crop Estimates

Let me talk a few minutes about corn. Anyone who lives in Iowa knows that great difficulties are involved in estimating the yield of this crop before harvest. Still, I think the Crop Reporting Service could do a better job than it has been doing in giving accurate indications of the condition of the growing crop.

As a user of corn-crop estimates, I should like to see reports every 2 weeks during July, August, and September. Once a month just isn't often enough to keep up with changing conditions during the summer. Frequently during these months farmers, businessmen, or Government officials must rely more upon private estimates made by members of the grain trade than upon the Crop Reporting Service. By the time the August 1 report comes out, usually around the tenth of the month, it may be obviously out of date. Then for 30 days you have to make your own judgments about the crop.

It should be possible also, I think, to get out estimates more quickly after the data are in. By using telephone, telegraph, and radio, could not these reports be issued 4 or 5 days after the date for which the information is collected? And what about these new electronic computers? Could they be used to speed up the calculating?

That brings up another suggestion which might contribute to both speed and accuracy. Would not probability samples, perhaps just for the mid-month reports, be a good supplement for the mail questionnaire returns? A small sample, if a good one, could provide better information, and the data could be processed more quickly.

One of the big criticisms of the corn estimates in recent years has been the tendency to underestimate the effects of unusual weather situations. We have had several cold, wet spring seasons during the last few years, and I believe the Crop Reporting Service has consistently failed to predict the effect on stands of corn, and on the yield. Perhaps this means that we don't have enough basic research on how such wet, cold planting seasons affect corn development. If that is true, then the solution is to get more such research studies started.

The crop reports seem often to underestimate the effects of dry weather during the growing season. You may have 3 weeks of very dry weather after the first estimate of yield is released on July 10. By August 1, the impact of this drought may not yet be apparent in the appearance of the corn. The State statisticians doubtless make some corrections because of the dry weather, but apparently they don't make enough. The reports may not indicate what has happened to yield until September, or even October. Here is another case where basic research regarding the effect of weather is needed —or needed to be *used*—in arriving at an estimate of corn production.

The corn borer has been hard to figure in recent years, too. As more experience is gained, this difficulty will be overcome, I suppose. It will require information on how much spraying has been done, whether it was done at the right time, and so on. Commercial fertilizer is becoming a bigger factor in corn yield every year. Should information on the use of fertilizer be gathered and taken into account in the reports?

All these factors I have been talking about imply that better crop reporters are needed—and that they should be distributed according to a logical sampling plan.

Facts on Feeding Value Needed

Getting an accurate estimate of the number of bushels produced is not an easy task, especially during a variable season, with unusual

quirks of weather and insect damage. But even doing a good job on bushel yields is not enough. We need more information on the feeding value of the crop—especially the moisture content. In 1951 the crop report overestimated the quantity of feed for livestock that was produced. This year I wonder if the feeding value is not underestimated—in spite of the fact that Iowa's crop is reported as the largest on record.

How to make an estimate of feeding value I will leave to the experts. But there ought to be some scientific way to do the job. Perhaps the total yield in bushels could be given, along with another figure adjusted for normal feeding value.

It would be helpful if information could be furnished on a smaller area basis. Suppose that each first-of-the-month report not only gave a production estimate by States but also by districts within the important corn States. There have been some fairly sharp differences in production in different areas of Iowa, but they are covered up by the over-all figure. What goes for production also goes for carryover.

I appreciate the fact that all this costs money, but it seems to me that the United States could well afford to invest more in this work of providing accurate statistics about our important crops.

To sum up what I have said about the corn estimates:

1. Make corn yields and production estimates every 2 weeks during the summer.

2. Publish the crop estimates more quickly after the basic data are gathered.

3. Place more reliance on historical and research data in trying to estimate the effect of unusual weather and insect damage—rather than relying on the appearance of the growing crop.

4. Make estimates of feeding value in addition to bushel yields.

5. Publish yield and carryover estimates on a smaller area basis.

Pig-Crop Estimates

Now let me say a word about the pig-crop reports. I was asked to talk only about corn, but I want to take full advantage of this opportunity to file requests.

The old semiannual pig-crop report is technologically obsolete. The pig crop is becoming more evenly distributed around the year, even in cold climates such as in Iowa, and we need more detailed facts on when the pigs are to be farrowed. The reporting service has been doing a good job of providing monthly estimates of farrowings in the spring. But this is a little late. Would it be possible to get farmers' farrowing intentions by months? Even if done by 2-month periods, it would help provide a better picture of future pork production. Then I think the surveys might well be made at least four times a year instead of twice.

I should like to close by filing a complaint about the way the crop report figures are published.

The figures released by the crop and livestock reporting service give a false impression as to their accuracy. This is especially true for the early reports of a crop season. The July corn estimate is given down to the last thousand bushels, which is plainly ridiculous. You may reply that anybody with good sense would *know* that the figure has a big margin of error. But lots of people don't have good sense.

Why not publish the figure to the nearest 100 million bushels in July and August, getting down to a finer point by October? Or if the statisticians insist upon publishing the figure carried out to the last three ciphers, why not publish along with it a probable error both ways?

Evaluation of Wheat Crop Production Estimates

By John D. Baker, Jr.

FORECASTS of wheat crop production are considered to be essential in our agricultural economy. They are going to be made, whether it be by businesses involved in the wheat trade, by professional forecasters, by the Government, or by others. In a free price system early appraisal of the supply, which is a fundamental price-making factor, will be attempted because it is a question of profit or loss to those who deal in and handle wheat. Those who have correctly anticipated the supply situation and acted upon it will be in much the better position. Others, realizing the importance of knowing what the supply is but having insufficient facts, may incorrectly appraise the situation, and lose thereby.

An appraisal of preharvest wheat crop estimates is in order, not only because correct knowledge of supply is essential but because Government estimates are relied upon extensively by the trade, by farmers, and by all who deal or trade in wheat. Such reliance causes these estimates to influence wheat prices and they often, for a time, become a dominant price-making factor.

At the outset it should be recognized that certain obstacles stand in the way of accurately anticipating the outturn of a crop. Weather, plant diseases, changing crop varieties, correct acreage, estimates which are often governed by farmers' attitudes, all complicate the situation. The fact that estimation is carried on in the face of these difficulties speaks well for the essential nature of it.

This discussion will center on an analysis of the accuracy of wheat-production estimates. The question is, How do crop estimates square with the final outcome of the crop? This does not deal in detail with methods of estimation or collection of data but is more concerned with the results that existing methods have produced. A critical analysis of methods is important, and it is to be hoped that such a review is or will be carried on by the Crop Reporting Service or by others. However, an analysis of past estimates should give some basis for putting the crop-reporting work in wheat in its proper perspective and for showing where weaknesses exist and where better methods are needed.

Four questions are considered in this discussion:

1. What is the average error in estimation?
2. Are there any biases in estimation which might be corrected?
3. Has there been any improvement in estimating crop production over the years?
4. How does accuracy in estimating wheat production compare with estimating accuracy in other economic areas in which prediction is common?

[*Part of Mr. Baker's discussion is omitted here, as it contains the substance of the wheat section in a paper published in* Agricultural Economics Research *for October 1952—"Outlook Evaluation—Methods and Results," by John D. Baker, Jr., and Don Paarlberg.*—THE EDITORS.]

As has been pointed out throughout this discussion, an examination of the results of crop-production estimation reveals some elements of improvement and some weaknesses. There has been some slight, though certainly not significant, improvement over the years in the estimating of the winter-wheat crop. This improvement includes a decrease in the magnitude of the error and in the tendency toward underestimation. The fact that errors have diminished more for the estimates nearer harvest in the more recent years indicates that the information the Crop Reporting Service received was more adequate or was better evaluated, or errors were more compensating in this later period.

The results of spring-wheat estimating can be looked upon with less pleasure. Improvement was not evident so far as this analysis was carried, either as to the range of error or in the tendency to estimate too low, although the downward bias was not so great in the case of spring wheat as with winter wheat. Some reduction occurred in the average total error.

Comparison with the other fields of estimating work indicate that crop estimates compare favorably in accuracy with many other types

of estimates. But it should be remembered that crop estimates should be more accurate, as the factors which influence prices and some other economic phenomena are very complex.

Many areas are open to improvement in the estimation work. Among the possibilities are: Better methods in sampling and the collection of data; improved statistical techniques for use in projection; more extensive use of objective measurements; and placing more emphasis on the timely and correct interpretation of abnormal conditions that might affect the crop, including better and more timely interpretation of the effects of weather. Accurate long-term weather forecasts would be a great asset to crop estimators, but they are not yet feasible.

Improvement may be limited by time and funds. Actually some savings or cuttings in funds are losses and false economy. Certainly some serious planning, thought, and investigation should be carried on aimed at (1) possible improvement in estimation work and (2) setting up organizational machinery so that progress can be made as time goes by. Much may be possible with only small increases in expenditures.

That crop estimation is imperfect does not mean that it is not of value. It is still useful and is counted on by many people as a reliable and unbiased source of information. Much market manipulation and misinformation is prevented by its use. But, it can and should be improved.

Probability Sampling as a Method of Obtaining Objective Facts

By Morris H. Hansen

THE RECOMMENDATIONS of the Special Subcommittee of the Committee on Agriculture on the crop estimating and reporting services of the Department of Agriculture and the discussion that has taken place here have made it abundantly clear that obtaining objective facts on which to base forecasts would be an important step toward the improvement of the present system. Probability sampling has been mentioned as a method of obtaining the facts but has been questioned chiefly on the ground that it is considerably more expensive than present methods.

In my opinion, probability sample surveys that will produce useful and timely results at acceptable costs can be established. Such surveys can assist in improving the accuracy of crop forecasts, although they will in no sense provide a complete solution of the problems. An exploration of the subject should include not only the question of what a well-designed probability survey would cost. In view of the amount of money at stake when the crop forecasts are in differing degrees of error, we should also explore the question of what it would be worth to achieve differing levels of accuracy in the basic facts used in forecasting.

First, it should be made clear that a probability sample survey will not yield objective predictions. But it can deal effectively with the factual aspects of the problem, such as measuring the acres in a particular crop at some point in time, the number of acres that have been abandoned, certain measures with respect to condition of the crop, or other facts capable of fairly accurate measurement on individual farms.

Objective sample survey methods have advanced to the stage where their application to the measurement of such characteristics is feasible and, at least for national estimates, can furnish results at moderate cost. Some added cost for achieving the protection provided by appropriate use of probability sampling would surely be justified in the light of the risks involved in a poor prediction. The committee report, for example, indicates that the high 1951 estimates on the cotton crop alone may have cost the farmers of the country 125 million dollars. The cost of objective surveys would be very small in comparison with this figure, and probably no greater than the cost of other surveys being conducted by the Government in fields of no greater importance.

Preliminary Experimental Work

Needless to say, it would not be feasible to put an effective probability survey into effect overnight. Some time would be required for experimental work before the survey could be put into operation in a form that would be most useful. Such experimental work should be devoted to questions of optimum measurement methods, including the use of mail, personal interview, or direct observations and measurements on fields, and combinations thereof; optimum follow-up methods; optimum estimating techniques; and related questions; and to the evaluation of results from the viewpoint of sampling and response variations. There should also be further opportunity for refinements in the prediction techniques, utilizing the objective results of the survey in combination with other relevant information.

A related experience in the Bureau of the Census occurred in the field of retail-trade measurement when a probability sample survey replaced a survey in which complete dependence was placed on a sample of cooperating respondents obtained by a mail survey without extensive follow-up, and based on readily available lists of stores. The combined use of mail, field enumerators, and telephone techniques with probability samples, raised the ultimate 10 to 15 percent rate of cooperation previously achieved in the survey to a rate of more than 90 percent.

Experience indicates that expenditures added to improve survey methods pay off at times when accurate measures are most needed. However, the improved methods now used for the retail-trade survey were achieved only after introducing probability sampling, and the results of experiments conducted on the best approach to the respondents, the content of the reporting form, and so on. The survey had a sampling error of only 1 percent for the national estimate of the level of sales and, because of its effectiveness in covering part-year operations, provided even more accurate measures of national sales than did the recent census of retail trade.

A sample survey could be designed that would produce results of a similar character in connection with acreages and production of important agricultural crops. Thus, a properly designed sample of about 5,000 cotton farms could produce national estimates of total acreage planted in cotton with an expected error of no more than 1 to 2 percent.

Summary

In summary, sample survey methods are now developed that could produce, on a reasonable time schedule and at moderate cost, objective information that would be exceedingly helpful in reducing errors in predicting crop yields. I believe that statisticians can and should provide those responsible for predictions with sufficiently accurate basic factual information. This is not to imply that probability sampling methods could completely displace other methods or the need for judgment in predictions. Nevertheless, they can provide objective information that would reduce substantially the degree of dependence on less satisfactory survey methods, judgments, and speculation.

Finally, as suggested in the Subcommittee Report, a program for objective measurement could be efficiently carried out by cooperation between the Bureau of the Census and the Bureau of Agricultural Economics. Initial planning for such cooperation already has taken place in connection with the discussion of plans for an annual sample Census of Agriculture.

Book Reviews

Economic Organization of Agriculture. By THEODORE W. SCHULTZ. McGraw-Hill Book Company, New York. 1953. 374 pages. $5.50.

ECONOMIC INSTABILITY has long characterized the agricultural economy of the United States. Its underlying causes and how best to deal with it are questions that continue to absorb the attention of economists and legislators. Dr. Schultz stands in the forefront of agricultural economists who have given attention to the problem. In his earlier book, *Agriculture in an Unstable Economy*, he analyzed the basic causes of the farm problem and discussed specific lines of action that he deemed necessary to obtain a better balance and a greater stability.

Economic Organization of Agriculture deals essentially with the same problem but develops, and substantially extends, the outlines of the analysis presented in the earlier work. Its focus is on how agriculture can best organize to cope with economic instability and economic development. Price and income instability in agriculture, Schultz believes, are due primarily to the relative price inelasticities of both the agricultural demand and supply schedules and the frequent and large shifts in a short interval of time in one or the other or both of these schedules. Yield instability, another main variable, is largely induced by weather since the aggregate quantity of inputs committed to farm production are remarkably stable from year to year.

One of the primary consequences of economic development, he suggests, has been a slowing down in the rate of increase in the demand for farm products. This he attributes to the diminishing rate of growth in population, the relatively low-income elasticity of the increase in income that comes from economic development, and the small effect in the aggregate of the additional demand to be had from better nutrition. Economic development also forces adjustments in the allocation of resources both within agriculture and as between agriculture and industry. This adjustment, however, is by no means uniform. It has worked better in the areas adjacent to the centers of industrial-urban development than in the more remote peripheral areas. This, he believes, is due to the poor way in which the various factor markets (labor, capital, and so forth) have functioned.

In turning to a consideration of the type of economic organization that will enable agriculture to cope in a more effective manner with economic development and economic instability, Schultz would improve the functioning of the labor market by eliminating barriers to migration by providing information about job opportunities, by making grants and loans to help people migrate, and by increasing the laborers' productivity and mobility. His suggestions for improvement of capital markets are less specific; apparently primary emphasis would be put upon measures to reduce uncertainty.

In dealing with the problem of instability Schultz suggests that the first necessity is to improve the stability of the economy as a whole. The appropriate measures for this, he believes, are primarily monetary and fiscal. But these, he recognizes, will not solve all of the instability in agricultural prices, hence, additional measures are needed. He has little confidence in production controls, price supports, and related measures of the type in use at present. In the event of a major depression, however, he would make income payments to farmers to safeguard their incomes.

His second line of defense would be to try to increase the price elasticities of both demand and supply schedules for farm products in such a way that the particular shifts of the demand and the year-to-year variations in production will not give rise to such marked disturbances in farm prices. Not much by way of economic organization, Schultz says, can be done to reduce the variations in yields caused by the weather.

By way of appraisal it should be said that readers likely will find little to criticize in Parts

I and II. Schultz's analysis of the causes of economic instability and the underlying conditions and factors affecting shifts in the demand and supply of farm products is exceptionally good. His rather detailed examination of the particular demand elasticities that are relevant in gauging the claims that changes in demand make on agricultural resources and their utilization is particularly well done. The same may be said of his analysis of the nature of economic progress and its effects upon agriculture. Here, however, he frequently explores new ground, and in recognition of this, is content to advance only tentative hypotheses until further exploration can be undertaken.

The ideas set forth in Part III are much more controversial and are more open to question. Schultz rejects most of the ways that have been developed during the last several years to combat economic instability in agriculture. He still thinks, however, that something positive can and should be done to reduce instability and to facilitate resource adjustment. His suggestions for improving the functioning of the labor market are positive and direct, and undoubtedly would be effective. His proposals with respect to the capital market are much more nebulous. There is a great deal of logic in his suggestions for increasing the elasticities of the supply and demand schedules of farm products. But he is by no means clear about the sort of practicable programs or administrative devices he would use or that would be effective in bringing this about.

Schultz's analysis almost completely ignores the bargaining problem between agriculture and other sectors of the economy. Galbraith, in his recent book, *American Capitalism,* seemed to think that this had a good deal to do with the farmer's position and his demands for Government assistance with respect to prices that are unfavorable relative to those received in the less competitive sectors of the economy. But the book is timely and undoubtedly will be helpful in contributing to the thinking involved in the widespread reexamination of our farm policies now under way. It is more likely to carry weight with those who have been critical of the agricultural programs of the recent past than with those who think that, despite some shortcomings, the methods that have been used actually have made a material contribution to the problem to which Dr. Schultz addresses himself.

F. F. Elliott

Economics of Agricultural Production and Resource Use. By EARL O. HEADY. Prentice-Hall, Inc., New York. 1952. 850 pages. $9.75.

MANY AGRICULTURAL ECONOMISTS have been wishing for a book such as this —a book that brings together in well-integrated form contemporary developments in economic theory and applies them to the solution of problems in agricultural production and resource use. Professor Heady has carried out this gigantic task in an effective and comprehensive way. The foundations of economic theory on which he builds include the writings of Hicks, Hart, Shackle, Samuelson, Stigler, Boulding, Lerner, Reder, Weintraub and many others. Numerous references are made to empirical studies not only to illustrate principles but, perhaps more important, to indicate how far applied study has progressed. We have in this book therefore not only a framework of logic and procedure for conducting research in the economics of resource use, but also an appraisal of much work that has been done and more that needs to be done.

The breadth and depth of the subject under study are indicated in a single chapter on the scope and nature of production economics. Production economics is defined as that branch of economics concerned with problems relating to the organization of production or resource allocation. This means, according to the author, that the only aspects of economics not covered are those relating to the organization of consumption or income allocation.

Following his statement of scope and method, the author deals with production and resource use in a static setting of perfect knowledge,

devoting 13 chapters to this aspect of the subject. He explains the basic concepts necessary for deciding how resources can be used most economically under different technical and price conditions for factors and products. Problems relating to classification of resources, returns to scale and farm size, valuation of resources, and interrelationships of firm-households are treated in great detail.

Production planning under the more general conditions of imperfect knowledge, wherein considerations of risk and uncertainty are essential, is dealt with in the five chapters that make up the third part of the book. This is a comprehensive and much needed treatment of decision-making from a forward point of view. It goes far toward explaining why resources are used as they are and how they can be used more efficiently.

In the last eight chapters, certain aggregative aspects of production not covered earlier are explained. Here the author covers production economic aspects of leasing and tenure systems, location and interregional specialization, product supply functions, efficiency in the agricultural industry, conservation and land use, and technological change and economic progress.

A commendable feature is the emphasis throughout on the universal nature of economic concepts and principles. They are applicable in deciding how resources can be allocated most efficiently among enterprises within firms, among firms within the agricultural industry, and among industries within the Nation. There are no unique principles which apply for different aggregates of production or for particular factors such as land, labor, or capital. Also commendable is the forthright manner in which errors in logic of many writings in the past are corrected. One example is the frequent practice, in individual farm, regional, or national studies of efficiency in resource use, of assuming that the marginal value productivity of a particular factor is equal to its average value or return in order to estimate the marginal value productivity of another factor. In actual fact, the marginal value productivity of a single factor such as capital, for example, may be much higher than its cost or average value.

The impact of the book on future work in agricultural economics is likely to be far-reaching, perhaps the greatest since that of *Production Economics* by Professor John D. Black in 1926. Professor Heady's book is the best single work available for advanced courses in the economics of agricultural production. Research workers will want to read it to get up to date on contemporary developments in the theory of production economics and their applications to studies they have under way.

Many may wish that analytical concepts and material were presented in simpler terms, to be more readily comprehended by those who are less familiar with the technical phraseology that has accompanied recent developments. Improvements in this respect will no doubt be possible.

Some may not agree that the theoretical framework for solving production problems is complete or entirely adequate. For example, institutional factors that influence resource use are given relatively little attention.

Everything considered, Professor Heady is to be congratulated on the great creative effort that he put into the preparation of his book, and on the significant contribution that the work adds to the literature of agricultural economics.

Raymond P. Christensen

The Politics of Agriculture. By CHARLES M. HARDIN. The Free Press, Glencoe, Illinois. 1952. 282 pages. $4.

FOR SEVERAL YEARS now, Charles M. Hardin, currently associate professor of political science at the University of Chicago, has been studying agricultural programs and their relation to the political process from the standpoint of a political scientist.

The importance of the field needs no elaboration beyond the opening sentence in M. L. Wil-

son's foreword which runs, "This is an era in which agriculture is deeply involved with government—local, state and national," or, as another reviewer has remarked, "... the growing commercialization, the expanding use of interest representation, and the increasing participation of government in agriculture demand that we look critically at both what the instrument of government offers agriculture and the contribution of agriculture to the strengthening of our democratic processes."

As suggested by Hardin's subtitle, "Soil Conservation and the Struggle for Power in Rural America," this study deals with only a portion of the agricultural policy field. Essentially, Hardin's attention is centered around soil conservation and competing and conflicting roles of the farm organizations and three public services or agencies—the Extension Service and Land-Grant College system, the conservation activities of the Production and Marketing Administration (and its earlier predecessor, the Agricultural Adjustment Administration), and the Soil Conservation Service.

The interesting thing about this study is Hardin's effort to study this whole process as an objective, non-partisan researcher, and our chief interest in it in this journal of course has to do with the methods or research tools used.

What methods has Hardin used?

Essentially, or so it seems to this reviewer, most of the book is given over to statements of facts, to an effort on the part of the author to set forth a factual description of the process of program development and administration in the conservation field. The description is drawn not only from innumerable published materials, carefully and adequately footnoted, but also from actual personal observations—observations which often give considerably more life and meaning to the facts than a straightforward restatement of previously published text might have allowed.

At first it seems that Hardin has not set forth definite hypotheses beyond a certain insistence that the political process is a healthy one, that it does operate in the field of agriculture, and that therefore it is worth our time to study and to understand it. But in this case at least there is much to be said for this calling attention to the process that is being studied, followed by a well-organized appraisal of the factual material. Further, as one progresses through the book, certain hypotheses or tentative conclusions do begin to stand out as Hardin from time to time refers back to, or endeavors to interpret, his material in accord with the principles of political science.

In the final section, there is a statement as to what Hardin believes the best goals might be, policy-wise; and a summary of his observations as to how the political process does work in relation to agriculture, clearly indicating that in getting answers one must look not only at general statements of policy but also at actual administration.

Surely this effort to study objectively and scientifically so difficult and controversial a subject deserves applause. This is especially true when one realizes the importance of the decisions which are reached through the process Hardin has chosen to observe and interpret.

O. V. Wells

The Land System in Palestine. History and Structure. By A. GRANOTT. Eyre & Spottiswoode, London. 359 pages. 1952. $4.50.

TO ANYONE who has followed recent developments in the land formerly called "Palestine," which is now divided into Israel and a small part of Jordan, the title of this book raises the question as to why a book just now released carries this title. Dr. Granott explains in a foreword to the English edition, and in the preface to the original Hebrew edition of 1948, that he began this work about 1936. Difficulties in collecting materials, particularly those concerning the early history of the land system of Palestine, required a longer time to complete the book than had been anticipated.

As it was completed at the time of the 1948 war in which Israel won its independence, it does not take into consideration the far-reach-

ing changes in land policies that have since occurred. Even so, the author rightfully states that "the work has a certain claim to completeness, since it brings us to the end of one period and the threshold of a new one. It contains the description of the land régime in Palestine from its early beginning before the Arab conquest until the last day of the Mandatory government."

Dr. Granott is thorough in describing the developments of the agrarian system through its many stages since early Roman times, with special emphasis on the régime under the Moslems. The book provides a comprehensive review of numerous subjects, such as the factors responsible for the emergence of large estates, the formation of State landed property, and the development of medium and small land ownership. Due consideration is given to the development of Jewish land ownership in comparatively recent times, particularly during the period between World Wars I and II. The author concludes with a discussion of tenancy and leasehold and the development of the different arrangements that have been and are now in existence.

The leasehold system is rather common in the Jewish rural economy, and its spread has been especially rapid since Israel's independence. Many settlements have been established under the system of ownership of the Jewish National Fund. Long-term leases, usually for 49 years, are granted and these may be renewed for a like period at the end of each term. Dr. Granott describes this system and explains its advantages.

The book will be of primary interest to land economists and should be read by students of the history of land conditions in the Middle East.

J. Richard Grant

Selected Recent Research Publications in Agricultural Economics Issued by the Bureau of Agricultural Economics and Cooperatively by the State Colleges[1]

BRODELL, ALBERT P., STRICKLER, PAUL E., and WALLRABENSTEIN, PAUL P. FARM POWER AND FARM MACHINES. U. S. Bur. Agr. Econ. F.M. 101, 35 pp. February 1953. (Processed.)

Shows numbers of principal machines and of work animals on farms, by States.

COLLINS, WARREN E., and TECHNICAL COMMITTEE OF THE SOUTHERN REGIONAL DAIRY MARKETING PROJECT. SEASONALITY OF SUPPLY AND UTILIZATION OF MILK IN THE SOUTH, 1949. Southern Cooperative Ser., Bul. 25, 59 pp., illus. July 1952. (RMA; Agr. Expt. Stas. of Ala., Ark., Ga., La., Miss., N. C., S. C., Tenn., and Tex., and BAE cooperating.)

In spring, supplies increased rapidly but the quantity used in fluid products declined; in fall, deliveries of milk by local producers declined, but the quantity marketed through fluid products moved to a seasonal peak.

[1] Processed reports are indicated as such. All others are printed. State publications may be obtained from the issuing agencies of the respective States.

DAVIDSON, R. D. FEDERAL AND STATE RURAL LANDS, 1950. WITH SPECIAL REFERENCE TO GRAZING. U. S. Dept. Agr. Cir. 909, 100 pp., illus. May 1952.

In 1950, Federal and State Governments together owned 535.9 million acres of rural land, or 28.1 percent of the total land area. An inventory of rural land owned by counties was found to be not feasible and was abandoned.

FELLOWS, I. F., FRICK, G. E., and WEEKS, S. B. PRODUCTION EFFICIENCY ON NEW ENGLAND DAIRY FARMS. 1. A PRELIMINARY APPRAISAL OF COST REDUCTION OPPORTUNITIES. Conn. (Storrs) Agr. Expt. Sta. Bul. 283, 51 pp., illus. January 1952. (BAE and N. H. Agr. Expt. Sta. cooperating)

Summarizes some of the important technological information now available to help farmers in estimating costs of production and operation. Additional research is needed in two categories: (1) The discovery of new production techniques; and (2) the measurement of crop and livestock response to variation in several variables in each production segment.

GILCREAST, ROY M. ELECTRICITY ON FARMS IN NORTH-CENTRAL NORTH DAKOTA. N. Dak.

Agr. Expt. Sta. Bul. 379, 50 pp., illus. October 1952.

In the cash-grain section of the State in which this study was made, the two chief factors that influence the amount of electricity used on farms are (1) the length of time the farm has been electrified and (2) the amount of farm income.

GREAT PLAINS COUNCIL. REDUCING ADVERSE EFFECTS OF RESERVOIRS. Kans. Agr. Expt. Sta. Cir. 293, 29 pp. October 1952.

This circular indicates some of the types of local problems that arise when reservoirs are built; reviews procedures used by the agencies involved or the laws that govern certain situations; and suggests ways of reducing the adverse effects on local people from construction of reservoirs.

HECHT, REUBEN W. LABOR AND POWER USED FOR FARM ENTERPRISES, INDIANA, 1950. U. S. Bur. Agr. Econ. F.M. 100, 33 pp. December 1952. (Processed.)

Shows man- and power-hours per acre in indicated areas of the State for each operation required in growing and harvesting the chief crops produced.

HOOFNAGLE, WILLIAM S. CHANGES IN THE MARKETING PATTERN OF FLORIDA FRESH ORANGES BETWEEN PREWAR AND POSTWAR PERIODS. 22 pp., illus. Bur. Agr. Econ. December 1952. (RMA) (Processed.)

Before 1939-40, more than 95 percent of Florida oranges marketed in any given crop year were sold for fresh consumption. Since World War II this situation has been reversed. In 1950-51, only 37 percent of Florida oranges were marketed in fresh form.

HOOFNAGLE, WILLIAM S. FACTORS AFFECTING THE ANNUAL AUCTION PRICE OF FLORIDA GRAPEFRUIT, 1930-51. 14 pp., illus. Bur. Agr. Econ. December 1952. (RMA) (Processed.)

Four factors combined account for most of the variation in the price paid for Florida grapefruit on 10 auction markets: (1) The quantity of Florida fresh grapefruit sold; (2) the total combined quantity of competing fresh grapefruit and grapefruit products sold; (3) the total combined quantity of fresh oranges and orange products sold; and (4) personal disposable income.

KUTISH, L. JOHN. REGULATIONS ON WEIGHT OF MOTORTRUCKS. PROBLEMS ILLUSTRATED BY WISCONSIN'S EXPERIENCE IN HAULING FLUID DAIRY PRODUCTS. U. S. Dept. Agr. Marketing Research Rept. 28, 49 pp., illus. November 1952. (An RMA contract report.)

In 1951, the Wisconsin legislature repealed the classification system on State truck highways, reduced the statutory single-axle load limit from 19,000 to 18,000 pounds, and provided that a tolerance of 1,500 pounds was to be granted by enforcement officials, but retained its existing bridge formula.

ROWE, GORDON A. ECONOMICS OF CHEESE MANUFACTURING IN TILLAMOOK COUNTY, OREGON. Oreg. Agr. Expt. Sta. Bul. 529, 31 pp., illus. December 1952. (RMA)

An analysis was made to learn the nature and extent of any economies resulting from consolidation of six small cheese plants into one large plant.

TEMPLE, FREDERICK C. SNAP BEAN MARKETING PRACTICES AMONG NEGRO FARMERS IN LOUISIANA, 1951 SPRING SEASON. 35 pp., illus. Bur. Agr. Econ. February 1953. (An RMA contract rept.) (Processed.)

Many producing units were too small; information as to demand, supply, and prices was lacking among many farmers; a few did not keep records of expenses and sales; credit was utilized by 19 percent of the farmers; quality should be maintained; and contract selling should be looked into.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. CROP PRODUCTION PRACTICES. LABOR, POWER, AND MATERIALS, BY OPERATION. GREAT PLAINS. U. S. Bur. Agr. Econ. F.M. 92, Sec. 4, 220 pp. January 1953. (Processed.)

Information is presented for each crop in each type-of-farming area of the Plains.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. OPINIONS OF HOMEMAKERS REGARDING FIBERS IN SELECTED ITEMS OF HOUSEHOLD FURNISHINGS. U. S. Dept. Agr. Marketing Research Rept. 26, 103 pp., illus. November 1952.

Consumers' reasons for accepting or rejecting the various fibers available to them in household furnishings are important to economists concerned with the marketing of textile fibers. Opinions given by a sample of homemakers in the United States are shown here.

Statistical Compilations

EDLER, G. C., KUZELKA, T. J., and SUTHERLAND, R. H., with the assistance of State Agricultural Statisticians and under the direction of C. E. BURKHEAD. FARM PRODUCTION, FARM DISPOSITION, AND VALUE OF FIELD SEED CROPS; REVISED ESTIMATES, 1939-50. U. S. Dept. Agr. Statis. Bul. 119, 65 pp. December 1952.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. PRODUCTION OF MANUFACTURED DAIRY PRODUCTS, 1951. U. S. Dept. Agr. Statis. Bul. 120, 36 pp. December 1952.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1953—202563

AGRICULTURAL ECONOMICS
RESEARCH

Is published quarterly by the Bureau of Agricultural Economics, U. S. Department of Agriculture. The printing of this publication was approved by the Director of the Bureau of the Budget, June 5, 1952.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 20 cents a single copy, 75 cents a year, domestic, $1 foreign.